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THE ROLE OF REVIEW MATERIAL IN CONTINUOUS PROGRAMMING WITH TEACHING MACHINES.

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STUDENTS WERE PRESENTED 61 LESSONS BY MEANS OF SEMIAUTOMATIC TEACHING MACHINES. LESSONS WERE ARRANGED SO THAT EACH PARTICIPATING STUDENT STUDIED PART OF THE COURSE MATERIAL WITH A SINGLE REPETITION AND PART WITHOUT REPETITION. DATA WERE OBTAINED FROM TWO TESTS SHOWING TEACHING-MACHINE RESULTS AND ONE FINAL COURSE EXAMINATION. NO SIGNIFICANT DIFFERENCES OCCURRED AS A RESULT OF THE LESSONS BEING REPEATED. STUDENTS REPORTED THAT THEY COULD MEMORIZE ANSWERS WHEN THEY TOOK THE LESSONS THE FIRST TIME, AND THAT REPETITION DID NOT CONSTITUTE AS MUCH OF A REVIEW AS IT MIGHT HAVE HAD THE MATERIAL BEEN DIFFERENT. (JH)

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The teaching machine has been a major development in teaching technique which promises to have large order-of-magnitude success in increasing the efficiency of the teaching processes and the amount of student motivation (Skinner, 1954; Skinner, 1958). Initial results with teaching machines indicate great promise for this method of teaching, but many technical problems are presented in the design of the actual teaching programs as well as in the design of the machines. One of the major by-products of the teaching machine is a method of evaluating objectively, and in an extended observation in an individual subject, the effects of various educational practices.

One of the major problems facing the designer of teaching programs is the degree of repetition of material that is necessary for proper retention. In the experiment reported here, the performance of the student was measured as a function of the amount of repetition of the material.

One of the approaches to the problem of adapting the student's individual rate of mastering the material in the particular teaching tapes has been to use a drop-out feature on the teaching machine. The machine is so constructed that when the student responds appropriately to a given portion of the tape, that portion is omitted on a second repetition of the lesson. This procedure gives the student extra practice in those parts of the program causing most difficulty. Ideally, a tape should be constructed so that the gradation of difficulty in the material is so designed that at each stage of the program, the student is so well-prepared for the next

item that there is no possibility of an inappropriate response. Present designs appear to require repetition, however. There is little information as to the need for review materials, or the effect of eliminating repetition in existing programs. The problem has great practical importance in the design of the teaching machine itself. The mechanical features neccessary to program the repetition of missed items is very expensive. If it were possible to present the didactic material without repetition, machines costing perhaps $10-30 could be used to accomplish essentially the same objective as that of the automatic machines costing on the order of $500.00.

PROCEDURE

The 61 lessons of the first revision of the Holland-Skinner psychology course were presented to the students in semi-automatic teaching machines (Ferster, 1960a, 1960b) which were kept on a reserve basis in the Medical School Library. The students could use the machines in the library or take them home. Lessons 22 and 37 of the program were test lessons designed to test the mastery of the immediately preceding materials. These tests were given in the library under controlled conditions, unlike the remainder of the materials which could be completed any place. When a lesson was to be repeated, a second copy of the lesson was pasted onto the end of the lesson, so that the student repeated the lesson simply by continuing to operate the machine. Half of the students studies Lessons 1-22 with only a single repetition, and half without repetition. The conditions were then reversed for Lessons 23-36 and again between Lessons 38 and 60. The 60-minute final examination consisted of 86 items taken from the teaching tapes. The questions were presented in irregular order and selected so as to cover the content of the course. The students were

given assurance that they would not be graded on the teaching-machine results, but only on the final examination.

RESULTS

The results of the experiment are presented in Table I, which shows the mean number of errors under the repeat and no-repeat conditions as well as the score on the final examination.

Table I

Mean and Standard Deviation of Numbers of Teaching-lesson Errors, and Scores on the Final Examination

	Repetition	Nonrepetition
Test I	Group A	Group B
	6.9 ± 6.6	9.4 ± 5.6
Test II	Group B	Group A
	7.9 ± 4.5	7.4 ± 6.1
FINAL EXAM		
	Group A	74.4 ± 8.0
	Group B	70.8 ± 9.0

In either group, no significant differences occurred as a result of whether the lessons were repeated or not. However, the number of errors made on the "teaching-machine tests" showed significant correlations with the scores on the final examination. These are shown in Table 2.

Table 2

Group A

	Test I	Test II
Test I	X	X
Test II	+ .63	X
Final	- .54	-.25

Group B

	Test I	Test II
Test I	X	X
Test II	+ .48	X
Final	- .15	- .05

The correlations are negative, showing consistency between the teaching-machine tests and the final examination. Teaching machine Tests 1 and 2 also were correlated.

RESULTS AND CONCLUSION

The results of these experiments give no evidence that simple repetition of the teaching lessons aided in their mastery. The tests which were given after portions of the teaching lessons that were repeated showed no higher level of performance than those that were not repeated. Students reported that they could essentially memorize the answers when they took the lessons the first time, and that the repetition did not constitute as much of a review as it might have had the material been different. Undoubtedly, a much better form of repetition is the kind already built into the teaching lessons, in which the student is given review of the basic concepts by a variety of examples which test the relevant concepts.

PUBLICATIONS

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